

We Claim:

1. A composition that includes a solid state film forming alkylsilsesquioxane polymer and an inert binder.
- 5 2. The composition of claim 1 wherein said solid state film forming alkylsilsesquioxane polymer comprises 10-50% by weight of said composition.
3. The composition of claim 1 pressed into a tablet.
- 10 4. The composition of claim 1 pressed into a metal cup.
5. The composition of claim 1 wherein said solid state film forming alkylsilsesquioxane polymer is derived from R_mSiX_n where the
15 non-polar R is a substituted silane or siloxane, an alkyl, a per-fluorinated alkyl, an alkyl ether, or a per-fluorinated alkyl ether group of 6-20 carbon atoms and most preferably 10-20 carbon atoms, where X is selected from the group consisting of halogens, hydroxy, alkoxy and acetoxy groups, and where m is 1-3, n is 1-3 and $m+n$ equal 4.
- 20 6. The composition of claim 1 wherein said solid state film forming alkylsilsesquioxane polymer is derived from R_mSiX_n , where R is C_{18} , X is an ethoxy group, m is 1-3, n is 1-3 and $m+n$ equal 4.
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7. The composition of claim 1 wherein said solid state film forming alkylsilsesquioxane polymer is derived from alkylsilanes.

8. The composition of claim 1 wherein said solid state film forming alkylsilsesquioxane polymer is derived from R_mSiX_n where R is an alkyl and alkyl ether or a fluorinated alkyl and fluorinated alkyl ether chain containing C6-C20, where X is Cl, Br, I, an alkoxy group or an acetoxy group, and where m is 1-3, n is 1-3 and $m+n$ equal 4.

9. The composition of claim 1 wherein said solid state film forming alkylsilsesquioxane is derived from octadecyltrichlorosilane.

10. The composition of claim 1 wherein said binder includes one or more of titanium dioxide, silica and alumina.

11. The composition of claim 1 wherein said binder comprises metal oxide powder.

12. A composition containing a metal oxide powder and 10-50% by weight of solid state film forming alkylsilsesquioxane polymer powder.

13. The composition of claim 12 wherein said composition is compressed into a tablet.

14. The composition of claim 12 wherein said composition is compressed into a metal cup.

15. A composition containing a metal oxide powder and 10-50% by weight of a solid state film forming substance having amphiphilic molecules that are capable of self-assembly into a thin film on a substrate surface.

16. A method of coating substrate surfaces with a hydrophobic thin film of amphiphilic molecules comprising the steps of positioning a substrate and a solid state film forming substance of amphiphilic molecules within a vacuum chamber, evaporating the film forming substance to form a molecular beam of amphiphilic molecules, and allowing the amphiphilic molecules in the molecular beam to settle on the substrate surface and self-assemble thereon into a hydrophobic thin film.

17. The method of claim 16 including the step of rotating said substrate while said amphiphilic molecules in said molecular beam settle thereon within said vacuum chamber.

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18. The method of claim 16 including the step of maintaining the temperature within said vacuum chamber at less than 100°C.

19. The method of claim 16 wherein said step of evaporating is carried out to provide a film formation on the substrate surface at a rate of 0.1-1.0 nanometers of film thickness per second.

5 20. The method of claim 19 wherein the film formation rate is 0.4-0.6 nanometers of film thickness per second.

21. The method of claim 16 wherein said method is carried out for a time to provide the substrate with a film having a thickness of 3-100
10 nanometers.

22. The method of claim 21 wherein the method is carried out for a time to provide the substrate with a film having a thickness of 6-15
nanometers.

15 23. The method of claim 16 including the step of maintaining the vacuum chamber at a vacuum of 1×10^{-4} to 1×10^{-6} torr.

24. The method of claim 16 wherein the step of positioning
20 a solid state film forming substance of amphiphilic molecules within a vacuum chamber is carried out by positioning within the vacuum chamber a composition that includes a mixture of an inert powder and a powdered film forming substance of amphiphilic molecules.

25. The method of claim 24 wherein the step of positioning a composition in the chamber is carried out by positioning the composition in the form of a compressed tablet.

5 26. The method of claim 24 wherein the step of positioning a composition in the chamber is carried out by positioning the composition compressed within a metal cup.

10 27. The method of claim 24 wherein the step of positioning a composition is carried out positioning a composition that includes a mixture of a metal oxide powder and a powdered film forming substance of amphiphilic molecules.

15 28. The method of claim 27 wherein the step of positioning a composition is carried out by positioning a composition that contains 10-50% by weight of the powdered film forming substance of amphiphilic molecules.

20 29. A method of coating substrate surfaces with a hydrophobic thin film of amphiphilic molecules comprising the steps of positioning within a vacuum chamber a substrate and a solid composition that contains a solid state film forming substance of amphiphilic molecules, heating the composition to evaporate the film forming substance and form a molecular beam of amphiphilic molecules, allowing the amphiphilic
25 molecules in the molecular beam to settle on the substrate surface and self-

assemble thereon into a hydrophobic thin film, and maintaining the temperature within the vacuum chamber below 100°C.

30. The method of claim 29 including the step of
5 maintaining the vacuum chamber at a vacuum of 1×10^{-4} to 1×10^{-6} torr.

31. In a method of producing a solid state film forming
alkylsilsesquioxane polymer of amphiphilic molecules by the hydrolysis and
polymerization of monomers, the step of heating the alkylsilsesquioxane
10 polymer in a vacuum to remove residual water therefrom and provide a
dehydrated product.

32. The method of claim 31 wherein the step of heating in a
vacuum is carried out at a temperature of 160-180°C.
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33. The method of claim 32 wherein the step of heating in a
vacuum is carried out at a vacuum at least as low as 1×10^{-2} torr.

34. The method of claim 33 wherein the step of heating in a
20 vacuum is carried out for at least one hour.

35. The method of claim 31 including the step of crushing
the dehydrated alkylsilsesquioxane polymer product to a fine powder.
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